PROGRESS REPORT

TECHNOLOGY APPLICATION CENTER

EVALUATION OF POTENTIAL USERS OF NASA GENERATED NATURAL RESOURCES INFORMATION

NASA CONTRACT NSR-32-004-013

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SUMMARY

This report is concerned with the identification of potential users of NASA-generated information that: (1) is of current or potential economic value to the natural resources community, and (2) is of such a nature that the transfer of the information to the natural resources industry is inadequately treated by existing information dissemination programs.

The investigators have learned that a considerable volume of earth attribute data and imagery have resulted from or will be generated by, remote sensing of environment and other experiments and orbital surveys conducted in conjunction with the Nimbus/Tiros, Mercury, Gemini, and Earth Resources Survey Programs. The fundamental nature of remote sensing data and imagery suggests that this material can be applied to commercial activities that are far more extensive than the objectives of the aerospace experiments that prompted the initial data acquisition. Prime candidates for the utilization of earth environmental data and/or imagery are firms whose interests encompass any of the following disciplines: agriculture, cartography, geography, geographic exploration, hydrology, forestry, meteorology, regional or urban analysis - including studies of population demography, transportation networks, oceanography, etc.

To date, efforts to disseminate earth attribute data and imagery to the public have been uncoordinated and informal. To determine the information requirements of the potential users, questionnaires have been mailed to 146 organizations selected by the Technology Application Center as a cross section of potential users. Data from this survey will be used to formulate requirements for an adequate system for natural resources information transfer which will be the final phase of this study.

To insure full benefits from NASA's remote sensing of environment experiments, it is essential to identify potential users and establish means of dissemination of information as early as possible. This new technology is anticipated to grow rapidly and produce data at a rate that will be difficult to cope with unless the systems for handling are devised in advance.

INTRODUCTION

A. Purpose

This report is submitted in compliance with the provisions of NASA Contract NSR-32-004-013 and constitutes the second progress report on the Technology Application Center's study of the applicability of aerospace-generated information to the natural resources industry. This second report is for the purpose of stating progress in identifying potential users of the natural resources information described in the first progress report "Evaluation of NASA Data Base for Application to The Natural Resources Industries" hereinafter referred to as Part I. A forthcoming report will be concerned with formulating a system for dissemination of the data determined in Part I to be inadequately announced or disseminated by existing technology transfer programs.

B. Objectives of the Investigation

The objectives of this study are fourfold:

1. To identify those NASA offices, programs, projects, and missions that have generated, or in the near future will contribute data or other scientific and technical information of concern to the natural resources industry. This objective was reached in Part I.

2. To identify and evaluate the adequacy of existing facilities for data and information storage, retrieval and dissemination. These facilities were found to be inadequate in the earlier report (Part I).

3. To survey the potential users of natural resources information and their requirements for orderly transfer of available information. As mentioned above, this objective is the purpose of this report (Part II).

4. To propose methods by which the Regional Dissemination Center, through its particular expertise, can aid in the orderly transfer of available information which is inadequately announced or disseminated by existing technology transfer programs. This final objective will be covered in a forthcoming report (Part III).

C. Definition of Natural Resources Industry

The natural resources industry is concerned with the exploration, evaluation, extraction, beneficiation, processing, conserving, and/or managing of the earth's resources. Information needs of the natural resources industry span the spectrum of scientific technical and managerial knowledge; however, the disciplines of especial interest can reasonably be summarized as including agronomy, biology, chemistry, forestry, geography, geology, hydrology, mineralogy, meterology, oceanography, and all

branches of engineering technology.

D. Scope of the Investigation

Part II of this study is a survey of the potential users of the natural resources information identified in Part I. This survey is being conducted in two ways. First, by personal interviews with the Center's member firms and other firms with which the Center has had close contact. Second, by a questionnaire prepared by the Center's staff for wider distribution. Appendix A contains a copy of the questionnaire the results of which will be included in the final progress report.

CONTACTS OF THE TECHNOLOGY APPLICATION CENTER WITH NATURAL RESOURCES ORGANIZATIONS

A. Members

1. Two major oil company research laboratories are full members of the Center. One has 150, the other 45, scientists and engineers actively engaged in research in the exploration, exploitation, and processing of petroleum and natural gas.

2. A small field research group of a major mining company is an associate member. This group is very active in exploration for minerals and particularly in practical and immediate applications.

3. An individual photogeologist is an affiliate member of the Center. This individual enjoys an excellent reputation in his field and has served as consultant in worldwide operations by oil and mining companies.

4. Two additional individual consultants with natural resources orientations are affiliate members.

B. Non-Members

1. One major oil company has indicated a preference for membership in the Technology Application Center because of its expertise in remote sensing. However, they are currently members of another Regional Dissemination Center.

Other oil companies which have been contacted in connection with the Center's recruitment drive have generally expressed interest

in the Earth Resources Survey Program even though they have not elected to join the total dissemination program. The main reason for not joining is skepticism of the applicability of aerospace technology in the mundane heavy equipment world of drilling and producing hydrocarbons.

2. All remarks concerning the non-member oil companies apply to mining companies, except that mining companies are even more conservative.

3. The country's largest photogeology consulting firm was purchased by an electronic company in order to have a built-in capability for interpretation of remote sensing data. This electronics firm is a prime research contractor to NASA and the military for development of infrared and radar scanning devices. The combination of instrument development and interpretive know-how makes this organization dominant in current industrial application of remote sensing for geologic purposes.

Several other photogeology consultants and firms have expressed interest in getting into the field of remote sensing, but the high cost of research has made it difficult or impossible.

4. The Center has had dialogue with only one private agricultural firm. It was determined that NASA's regular information base is inappropriate; however, they did express interest in remote sensing but declined to join the Center until more information is available.

The Center is currently supplying natural resources information to the University of New Mexico, University of Arizona, University of Utah, and Odessa College.

C. Requests for Information

1. Requests for natural resources information from members generally result from their need to know. Additional inquiries are prompted by Industrial Applications Reports prepared by the Center's staff which list significant documentation either from NASA's information bank or from other sources.

2. Natural resources information requests from non-members have been generated by personal contacts during sales presentations, professional society meetings and through newspaper and other publicity.

3. Referrals by Technology Utilization Officers, geologists, photographers, etc. within the NASA family have resulted in inquiries from several individuals and companies.

D. Kinds of Data Requested

1. During FY 1966-67, Retrospective Searches have been requested on the following natural resources subjects and in the noted quantities:

a)	Geology	10
b)	Geochemistry	3
c)	Geophysics	3

d) Mineralogy 4

e) Photogeology 2

This represents 14% of the total number of searches run by the Center for the year to date.

2. Selective Disseminations in the following natural resources fields are being made on a semi-monthly basis:

	Private Firms	Institutions
Geology	5	5
Geophysics	4	4
Geochemistry	4	4
Mining Engineering	1	1
Pipeline Engineering	2	0
Reservoir Engineering	1	0
	17	14

These are from the regular NASA tapes and abstract journals, with supplementary material from Nuclear Science Abstracts, Technical Abstract Bulletin, and U. S. Government R & D Reports. Document requests from these reports have been substantial.

3. The Center produces its own Industrial Applications Reports on significant items from all sources. Periodic IAR's are also distributed to annòunce acquisitions to the Center's Natural Resources Library. A large portion of the latter material is from the backup documentation of the Earth Resources Survey

Program Data Bank at the Manned Spacecraft Center. The use of this library will increase once a policy is estaboished for acquisition of the imagery from the program. (See Part I).

4. The Center has established its own film library for the imagery from the Gemini Synoptic Terrain Photography Experiments. This has proven of extreme interest to a number of natural resources firms in that it allows them to see for themselves that hyperaltitude photography is useful for terrain analysis and regional geological interpretation.

Approximately 900 frames from GT IV through GT XII have been selected, cataloged, and evaluated. Preliminary catalogs by the Manned Spacecraft Center list all frames in chronological order with only a concise description and some notation as to quality. These have proven inadequate because users want to know what areas the imagery covers and if they are useable for their own purposes.

To date approximately 2500 photographs have been distributed to both members and non-members.

E. Regular Dissemination Program

1. No definite reports have been made of either partial or complete transfers resulting from retrospective searches, selective disseminations, or industrial applications reports. Follow-up dialogue has elicted some expressions of "usefulness" and

promises of affirmative testimonial letters. The extractive industries by nature are secretive and documentation will be difficult to obtain.

F. Gemini Synoptic Terrain Photography

1. Documentation has been obtained of a potentially valuable mineral discovery as a result of following a geologic lead from one of the Gemini pictures. Because of the proprietary considerations, the location and nature of the find cannot be disclosed at this time.

POTENTIAL USERS OF NATURAL RESOURCES INFORMATION

A. Industrial Survey

Questionnaires (see Appendix A) have been mailed to potential users of natural resource data in the following categories:

1. Private Industry
   - a) Extractive
     - Petroleum and Natural Gas
     - Mining
   - b) Service Organizations
     - Geological Consultants
     - Geophysical Consultants
     - Civil Engineering Consultants
     - Meteorological Consultants
     - Hydrological Consultants
     - Agricultural Consultants
   - c) Supporting Industries
     - Instrument Manufacturers
   - d) Marine Industries
     - Shipping
     - Mining
     - Food
   - e) Agriculture

f) Forestry

2. Institutions

a) Colleges & Universities

b) Research Centers

c) Museums

3. Information Services

a) Publications

b) Dissemination Centers

It is anticipated that this sampling will provide an assessment of the present and future need for natural resources information. Calling attention to NASA's experiments in the field may also stimulate some organizations into re-evaluating the space program as a source of outside generated technology. Analysis of the survey and recommendations based thereon will be the subjects of the final phase of the current study.

CONCLUSIONS

Minerals exploration firms are expected to be immediate primary consumers of the technology that is to be generated in the development and evaluation of remote sensing equipment. Initial efforts will be directed to surveys from aircraft of selected areas of the earth that have been designated "ground truth test sites." While the major reason for extensive data collection in truth test sites is to provide reference for testing and evaluation (calibration) of remote sensing devices, the geological data that is collected at the sites should be of great interest to explorationists. Any immediate discoveries of important mineral deposits, although possible, will be accidental; nevertheless, the accessibility of the raw data for the exploration companies' own evaluation of the capabilities of the remote sensors is essential to the stimulation of their broad use in search for vital natural resources.

Other users of natural resource data e.g. agriculture, shipping, etc. will benefit more from repetitive surveys analogous to the current weather satellites. Repetitive surveys will require more co-operative efforts, and may be entirely dependent upon governmental and/or private - governmental corporations.

It is certain that this bold new technology of remote sensing of environment will benefit all of mankind. The population

explosion assures the accelerated use of non-replaceable natural resources and it is imperative that proper inventories be taken on a global scale. Management and dissemination of the vast quantities of data from fully operational satellites will be a formidable task. Hence, it is essential that channels be established to provide for the widest practicable and appropriate dissemination of information concerning remote sensing during the program's infancy to insure a well-informed cadre of users.